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Contingent Valuation
of a Quasi-Market Good:
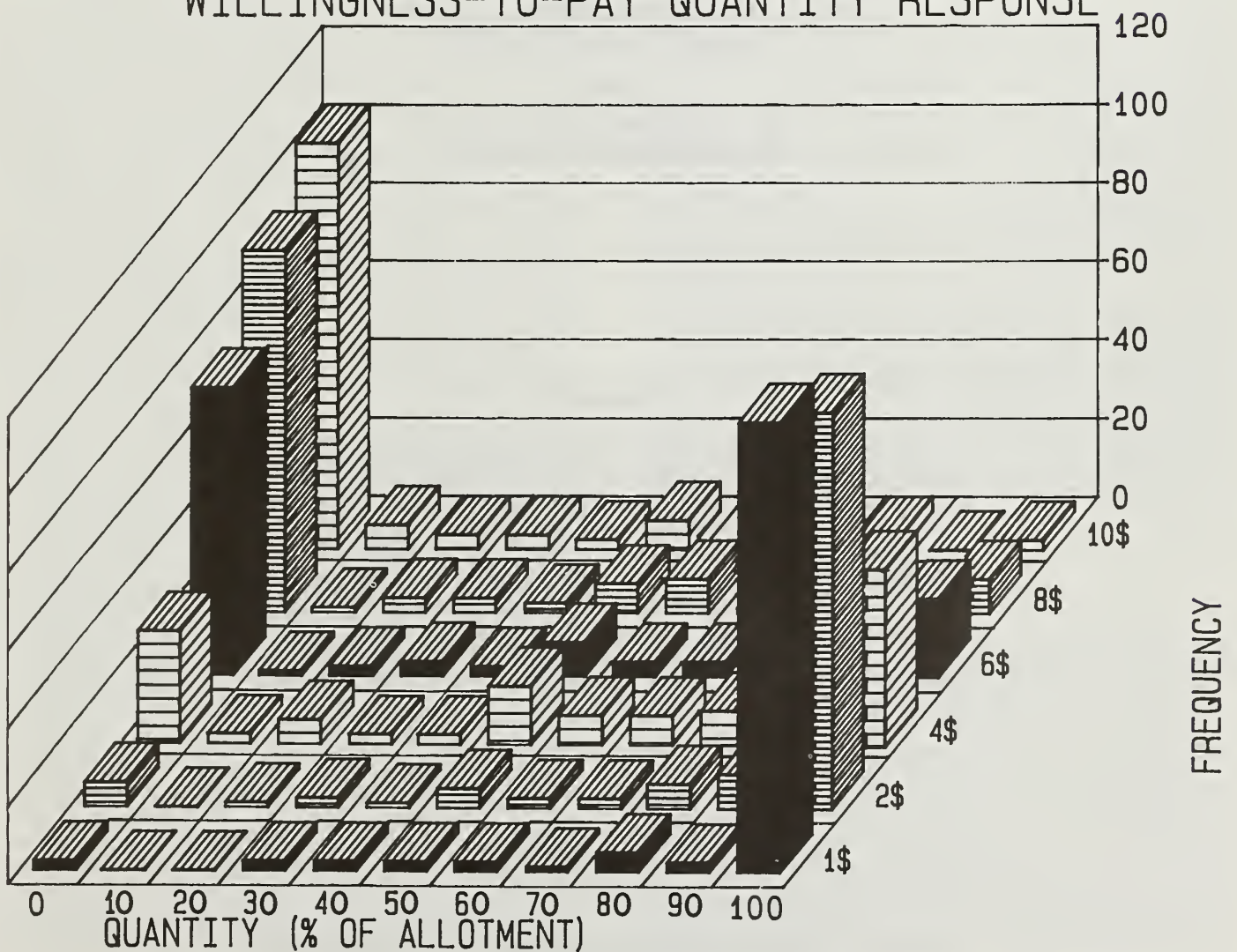# An Exploratory Case Study
# of Federal Range Forage

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WILLINGNESS-TO-PAY QUANTITY RESPONSE

Contingent Valuation of a Quasi-Market Good: An Exploratory Case Study of Federal Range Forage

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Abstract

The Contingent Valuation Method (CVM) is applied in four different formats to value federal range forage. Price-response formats tend to elicit bids reflecting either the current federal lease rate (willingness to pay) or the current private selling price (willingness to sell). This type of influence from real world prices may explain some of the large difference often observed between willingness-to-pay and willingness-to-sell contingent valuations. Quantity-response formats tend to elicit all or nothing bids. Logit demand functions are estimated for a quantity-response willingness-to-pay format, and the results are compared with other market-based valuations of federal range forage in Colorado.

Contingent Valuation of a Quasi-Market Good:
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Introduction

The Contingent Valuation Method (CVM) has received considerable attention in the agricultural and resource economics literature (for an excellent review of CVM, see Cummings et al. 1986). It has been applied to many different commodities, the most common being aesthetic and environmental improvements and recreational activities. The purposes of this paper are to investigate the use of the CVM in valuing federal range forage and to report some indications about CVM that this investigation suggests. Valuation of publicly-provided range forage has been approached with a variety of techniques, generally based on comparison with market-priced substitutes, observing market prices for federal grazing permits where such markets have developed, or optimization analysis of the production unit (the ranch) to determine a value-marginal-product factor price. The last of these approaches requires a rather extensive analysis of ranch operations (Bartlett et al. 1981). Federal forage is sold for a fee that is typically lower than its value-marginal-product in producing livestock products (Bartlett et al. 1981). In Colorado, the fee is approximately $1.35 per animal unit month (AUM). Privately owned forage, a close substitute, is sold at a much higher price—approximately $6.70 per AUM, according to the survey discussed below. In general, the purchaser of a USDA Forest Service grazing permit cannot legally resell the permit to another party, except in special circumstances. Bureau of Land Management permits can be subleased legally. And, close substitutes such as hay and similar feeds are available whose prices may influence the demand for federal forage. This situation is a quasi-market because the rancher is accustomed to paying a fee for the federal forage, and because markets do exist for highly interrelated factors of production (private grazing and other feeds). Federal range forage is differentiated from these related factors on the basis of seasonal availability, quality, accessibility, extra user costs, and continuity of lease regulations.

Because of this quasi-market, CVM analysis of federal range forage is used to investigate several issues in this paper. First, as Knetsch and Sinden (1984, p. 507) point out, "Two bases are used for assessing changes in economic welfare and measuring the value of an asset or use of resources: the maximum willingness to pay to maintain an entitlement and the minimum compensation necessary to accept its loss." Gordon and Knetsch (1979) concluded from a review of empirical demand studies (including CVM studies) that discrepancies exist between willingness-to-pay and willingness-to-sell measures that cannot be explained with the standard analysis of income effects. It is hypothesized here that one explanation of this discrepancy may be a "haggler's effect"—CVM responses may be affected by the presence of disequilibrium prices. That is, respondents may tend to be affected by what they think they could sell the given commodity for in willingness-to-sell responses, and by what they are currently paying in willingness-to-pay responses. Because the quasi-market described above exists for federal range forage, it is more likely that a pronounced haggler's effect would be observed in this case study than in typical CVM studies.

Second, most CVM studies elicit maximum price or total value bids for given quantities (see references above). Given the hypothesized haggler's effect, an approach to CVM is investigated here, where a maximum quantity-response to given prices is elicited. Ranchers are accustomed to making quantity decisions, given prices, in the quasi-market for federal range forage. This approach may often emulate the decision-making process that CVM respondents are accustomed to, and may thus be more appropriate for a wide range of valuation problems.

Third, a number of valuations of range forage based on market evidence and on studies of ranch operations are available that will serve as a standard of comparison for the CVM results. Bishop and Heberlein (1979) suggest that such comparisons are important in developing and refining the CVM approach. A case study will be described next, followed by a discussion of haggler's effect, a demand analysis, and comparisons with other studies.

The Case Study

There were 1,530 ranchers in Colorado who leased federal forage for summer grazing of cattle in 1983. One thousand of these were randomly selected and surveyed with a mailback survey in the winter of 1983–84. The survey questions and ensuing demand analysis applied exclusively to summer (1983) cattle grazing. In addition to the CVM questions, the survey collected information on variables that might affect the valuation as demand shifters. The survey is presented in its entirety in McKean et al. (1986). Whenever possible, U.S. Water Resources Council (1979, 1983) recommendations were followed, as well as the procedures suggested by Dillman (1978). However, the special characteristics of the study

population were also important considerations. Unlike some CVM studies that directly elicit a total willingness to pay (an approximation of the compensating or equivalent variations), a demand function was desired here—the available standards of comparison from other studies are factor prices. And, ranchers are much more accustomed to prices-per-AUM than total bids. In designing the CVM questions, indirect vehicles such as "grazing taxes" were avoided because of the possibility of this vehicle causing protest bids. Vehicle-caused biases may persist, but ranchers are accustomed to fees per AUM and attempts to avoid this traditional vehicle did not seem likely to succeed.

This study included four different approaches to the CVM: eliciting price responses and quantity responses for willingness to pay and willingness to sell. This necessitated four different CVM question formats. For the price-response CVM's, a series of quantities, expressed as a percentage of current summer federal grazing allotment, was given and a price bid per AUM was requested. For the quantity-response CVM's, a series of prices was given and a quantity bid, again expressed as a percentage of current federal allotment, was requested. Maximum quantity bids were requested for both willingness-to-pay and willingness-to-sell formats. Maximum price bids were requested for the willingness-to-pay format, and minimum price bids were requested for the willingness-to-sell format. The ranchers were instructed to assume a constant herd size throughout the questionnaire.

The questions were open-ended, so there should be no starting point bias (though it is recognized that the open-ended format is not completely free of difficulties either). In each survey format, a range (high and low) of responses was obtained to accommodate uncertainty on the respondent's part. In the demand analysis that follows, a test (t) indicated that this factor was insignificant as a demand shifter. Thus, the high bids were used for the remainder of the analysis and are reported here—except for the willingness-to-sell price-response format where the low bids are reported.

A mailback presurvey (in all four formats) was initially carried out with a randomly selected sample of 238 ranchers; Water Resources Council (1979) procedures recommend a presurvey of at least 200 individuals. The response rate to the presurvey was approximately 15%, and comments on some of the returned questionnaires indicated that the CVM questions were difficult to understand. Thus, the questionnaires were shortened considerably (deleting questions where responses showed no variance in the presurvey), and the CVM questions were made more explicit. However, the response to the first mailing of the 1,000 survey forms (250 in each of the four CVM formats) was slightly lower (approximately 12%) than that to the presurvey. Because of the controversial nature of federal grazing fees, and because ranchers are understandably cautious regarding this issue (their very livelihoods are involved), a high response rate could not be expected. The response rates for the four formats were:

Willingness-to-pay price-response:
14.0% (35 out of 250)
Willingness-to-sell price-response:
9.2% (23 out of 250)
Willingness-to-pay quantity-response:
11.6% (29 out of 250)
Willingness-to-sell quantity-response:
11.6% (29 out of 250)

It was also decided, based on this first mailing, that the willingness-to-pay quantity-response format was the only one that would be used in a demand analysis so in a second mailing, *all* previous nonrespondents received questionnaires in this format. This yielded a total of 136 responses, 109 of which were usable for demand analysis after obvious protest responses were deleted. Even though the response rate to the survey was not high, the effective sample size is actually relatively large. The 109 usable responses to the willingness-to-pay quantity-response format represent approximately 7% of the universe. This compares quite favorably with most CVM studies; but of course, the possibility of nonresponse bias remains.

Analysis of variance tests were performed to test for significant mean differences between the initial 29 responses and the second 107 responses to this format. The standard F ratios (between-group mean square over within-group mean square) for the quantity responses to prices of $1, $2, $4, $6, $8, and $10 were 5.65, 1.26, 0.0064, 0.48, 0.61, and 2.88, respectively. Critical F values with 1 and infinite degrees of freedom are 3.84 with 95% confidence and 6.63 with 99% confidence. Thus, at least one of the mean quantity responses (to a price of $1) is significantly different with 95% confidence (but not 99%). The mean quantity bids for these prices in the first mailing were .86, .84, .59, .36, .23, and .16, respectively. For the second mailing, the mean quantity bids were .99, .91, .59, .31, .18, and .08, respectively.

A set of F ratios was calculated in a similar way for changes in expected (next year) income, herd size, and the percent of total summer grazing that the respondent obtained (in 1983) from federal sources. They were 4.13, 6.91, and .74, respectively. The means of these variables in the first mailing were −4.2%, 547 animal index units, and 54%, respectively. The means of these variables in the second mailing were −9.8%, 303 animal index units, and 47%, respectively. The insignificance of the F ratio for dependency on federal forage is encouraging, because it most directly indicates the rancher's vested interest in the topic of the survey—federal grazing. Because some of these F ratios are significant with a relatively high level of confidence (95%), however, some evidence exists that responses to the two mailings are not statistically indistinguishable. The possibility of response bias in the total sample (both mailings) cannot be ruled out, but because no reliable population characteristics are available, clear conclusions are not possible. Thus, all results presented henceforth can only be applied with complete reliability to the sample, as opposed to the population. The results are intended to be exploratory, rather than policy-oriented.

Haggler's Effect

The price-quantity results of the willingness-to-pay price-response format are shown in figure 1. The price bids in figure 1 are predominantly in the range of $0–3 regardless of the quantity specified. This suggests a "haggler's effect" in that most respondents are inclined to respond near the lowest credible bid, the current federal lease rate. The rancher, in a purchaser's role, would rationally attempt to "haggle" for the minimum price, and the respondents apparently felt constrained by the prices currently faced for federal forage. This could be viewed as a special type of strategic bias.[2]

The price-quantity results from the willingness-to-sell price-response format are given in figure 2. As opposed to figure 1, this format tended to elicit price responses in the range of $5–10. In the role of a forage seller, ranchers would rationally try to maximize the price. Most respondents apparently felt constrained by the highest available price for this sort of commodity—the current price for privately owned grazing leases. Also, comments were frequently written in that this question made no sense or was illegal—it is a violation of federal regulations to sell some federally-leased forage to another party.

Both of the price-response formats appear to have been affected by the presence of the two current prices and are probably more indicative of what ranchers would *try* to buy or sell forage for, rather than what they would actually be willing to buy or sell it for. This has been termed a "haggler's effect." It has previously been pointed out that willingness-to-pay and willingness-to-sell responses in CVM studies are often widely disparate (Gordon and Knetsch 1979, Knetsch and Sinden 1984). It has also been pointed out that, typically, income effects cannot adequately explain this disparity. If the hag-

[2]*Other strategic biases may have caused the large number of zero price bids. The zero bids could also be protest bids of one sort or another.*
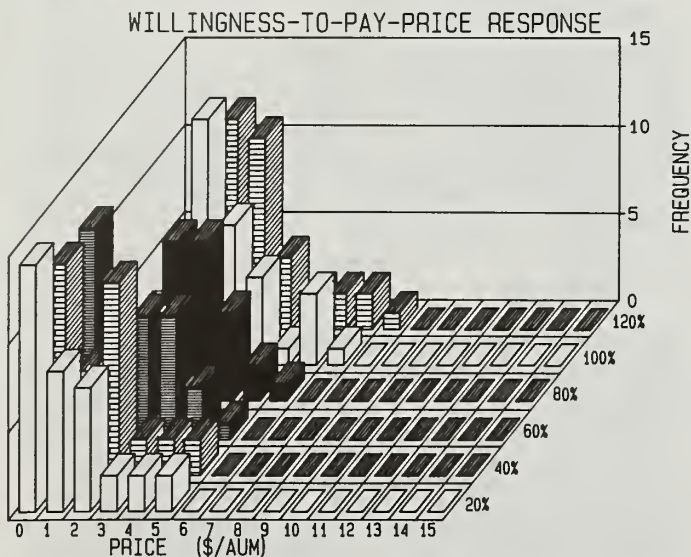

WILLINGNESS-TO-PAY-PRICE RESPONSE

Figure 1.—Three-dimensional histogram of the frequency of the willingness-to-pay price bids at the given percentages (20, 40, 60, 80, 100, and 120) of the current allotment.
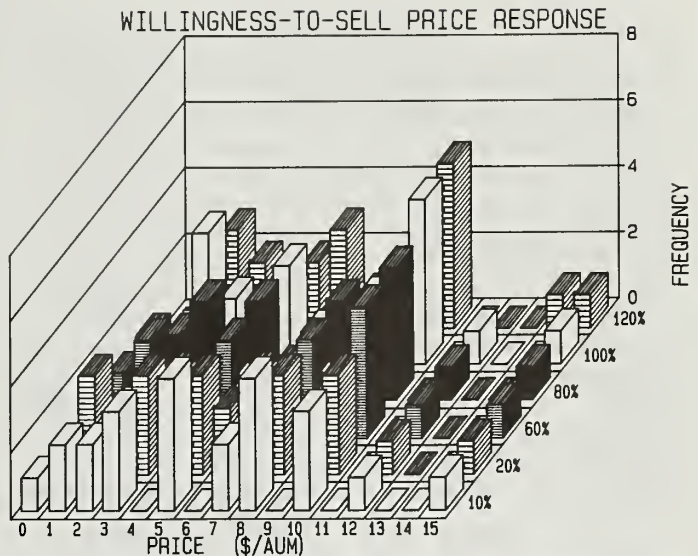

WILLINGNESS-TO-SELL PRICE RESPONSE

Figure 2.—Three-dimensional histogram of the frequency of the willingness-to-sell price bids for the given percentages (10, 20, 60, 80, 100, and 120) of the current allotment.

gler's effect is the correct interpretation of the results, then the disparity between figures 1 and 2 is easily explained. If this effect is more widespread than has been recognized, then this might be an important factor in explaining the disparity between willingness to pay and sell in other CVM studies as well.

Quantity-Response Formats

Given the anticipated results of the more conventional price-response CVM formats, quantity-response formats were also utilized. This approach is unusual in the CVM literature, but it could be argued that consumers are more accustomed to reacting to fixed prices with quantity decisions than vice versa. Also, situations such as this one, where price responses tend to be influenced by real world (disequilibrium) transactions, may be rather common. The quantity-response approach is an obvious alternative.

The price-quantity results of the willingness-to-sell quantity-response format are given in figure 3. These results indicate a strong tendency for the ranchers to "cling" to their current allotment (100%) until some threshold price, when they tended to reduce their quantity retained to zero. This type of response was also obtained in the willingness-to-pay quantity-response format, discussed below. This format was not analyzed further because, as discussed above, the ranchers had considerable difficulty responding to a question that involved a potentially illegal act. It should be noted, however, that no haggler's effect appears to be evident in figure 3—the quantity bids do not cluster near 100% at prices near $8.

The price-quantity results of the willingness-to-pay quantity-response format are given in figure 4. This quantity-response format elicited even stronger "all-or-nothing" responses than the previous one. Possible explanations for this response would include: (1) a strategic

bias intended to promote continuation of the current federal lease rate; (2) a belief (realistic or otherwise) that if prices for federal grazing exceeded a certain threshold, financial viability of the entire ranch was in doubt; (3) the availability of private grazing (presumably an elastic substitute) to which the rancher would switch if the price of federal grazing approached the private lease rate; and (4) a difficulty for the ranchers to subdivide (or perceive of subdividing) their current operation. Also, essentially no responses above the current federal grazing allotment (100%) were obtained. This may have resulted from the wording of the CVM question, but the quantity range of interest was between zero and current levels in any case. This format indicated a clearly downward-sloping price-quantity relationship, and the bids in this format did not appear to reflect the haggler's effect encountered with the price-response formats. And, there were no
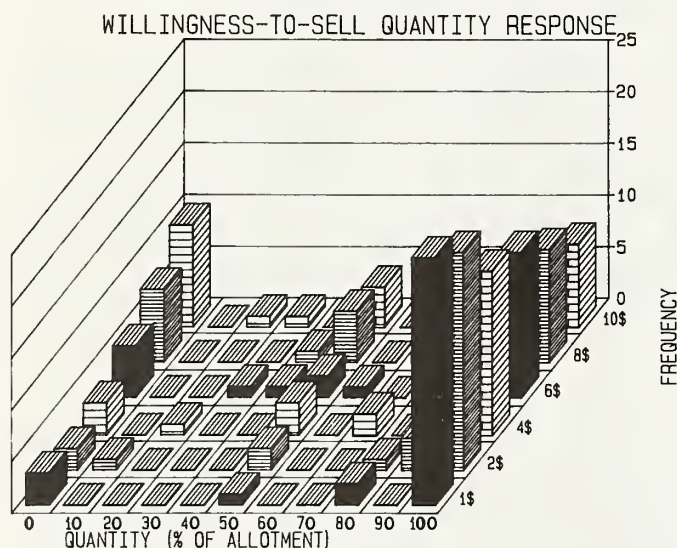

Figure 3.—Three-dimensional histogram of the frequency of the willingness-to-sell quantity bids (retained) at the given prices of $1, $2, $4, $6, $8, and $10 per AUM.
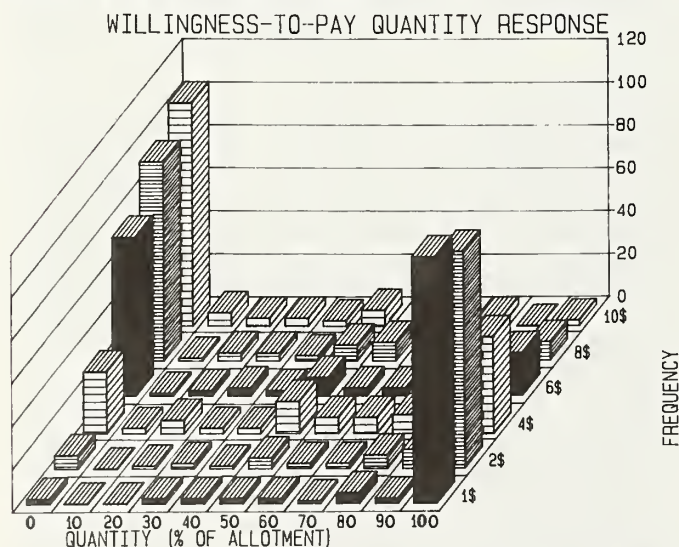

Figure 4.—Three-dimensional histogram of the frequency of the willingness-to-pay quantity bids at the given prices of $1, $2, $4, $6, $8, and $10 per AUM.

responses such as those encountered in the willingness-to-sell formats due to illegality of selling federal range forage. Thus, it was analyzed further in a more traditional demand analysis.

Demand Analysis of the Willingness-to-Pay Quantity-Response Format

The general form of the factor demand function is hypothesized to be:

%QUANTITY = f(PRICE, SIZE, EXPECT, FED, BEHAVIORAL VARIABLES)

where:

%QUANTITY is the CVM quantity demanded as a percent of current allotment (Animal Unit Months).

PRICE is the factor price in the CVM question.

SIZE is a measure of the scale of the ranching operation owned or operated by the respondent. This is an index representing the cattle inventory on the ranch prorated by the respective animal unit weights and the length of time each animal stayed on the range. Data for developing this index were obtained from Bartlett et al. (1979).

EXPECT is the respondent's reported change in expected net income for the next year.

FED is the reported percent of total summer grazing that the respondent obtained in 1983 from federal sources.

BEHAVIORAL VARIABLES are a set of six variables measuring potential motivations for the rancher to be in the ranching business; and a 0–1 variable (WOULD SELL) indicating whether or not the rancher expressed an interest in selling his/her ranch. The first six variables were ranked from one (highly important) to four (not important) by the respondent. These six potential motivations were, briefly:

1. a land ethic (LAND ETHIC);
2. the quality of family life on a ranch (FAMILY LIFE);
3. social ties (SOCIAL TIES);
4. perceived difficulty of the rancher in changing to a different livelihood (LABOR MOBILITY);
5. perceived difficulty in liquidating the ranch (ASSET MOBILITY);
6. importance of investment return (PROFIT MOTIVE).

Inclusion of rankings in a regression analysis treats ordinal data as if it were cardinal. The immediately obvious alternative would be to treat each response as an ordinal classifier and then use dummy variables to account for differences between groups. With six behavioral variables and four classes for each, plus the WOULD SELL variable, this approach would require a great many dummy variables—19 for intercept shifters and an additional 19 if slope shifters were desired. This did not appear to be a workable approach. Instead, a cluster analysis was performed on the responses to all seven

Table 1.—Cluster mean, standard deviation, and F ratio from an analysis of variance between clusters for each behavioral variable within each cluster group for ranchers responding to the willingness-to-pay quantity format.

Cluster number		WOULD SELL RANCH	LAND ETHIC	FAMILY LIFE	SOCIAL TIES	PROFIT MOTIVE	JOB MOBILITY	ASSET MOBILITY
1	mean	0.60	2.60	2.75	3.47	2.61	2.80	1.94
	sd	0.49	1.11	1.13	0.82	1.21	1.08	0.80
2	mean	0.86	1.47	1.23	1.87	2.33	1.43	1.67
	sd	0.34	0.50	0.42	0.76	0.87	0.56	0.83
3	mean	1.00	1.55	1.19	2.81	2.63	3.50	3.21
	sd	0.00	0.79	0.44	0.97	1.07	0.76	0.98
4	mean	0.00	1.29	1.24	2.88	2.53	3.88	2.24
	sd	0.00	0.46	0.42	1.13	1.04	0.47	1.06
GRAND MEAN FOR ALL CLUSTERS		0.75	1.68	1.48	2.68	2.53	2.90	2.46
F ratio		367.50	74.80	206.20	77.70	3.10	349.80	118.00
p value		0.00	0.00	0.00	0.00	0.01	0.00	0.00

behavioral variable questions.[3] The cluster analysis was done with two through eight clusters. It was judged that the results with four clusters were the most reasonable. This was admittedly judgmental, but with fewer clusters the groups seemed quite homogenized and with more clusters the groups seemed to be at least partially fabricated. A summary of this cluster analysis is given in table 1. Demand analysis was then performed with dummy variables (intercept shifters) to account for differences between these four groups. None of these dummy variables contributed significantly to the demand function estimation.

It was not possible to include prices of substitute factors of production (such as hay prices and private lease rates) because of a lack of variation in these prices across observations. Also, a multiplicative interaction term between FED and PRICE was included because it was expected that the proportion of summer grazing that the ranch obtained from federal sources might affect the price coefficient.

Constancy of the variance in the residuals across observations with different ranch sizes (put into five categories) was tested using the Levenes test. This test failed to reject constant variance, providing some evidence that there is a lack of heteroskedasticity with regard to ranch size. This was of concern because the study involved cross-sectional data from many different types (especially sizes) of ranches. Collecting quantity responses in terms of percentages of current allotment may have helped along these lines, though this was done initially to make the CVM questions easier to answer.

Examination of the relative frequency of response (fig. 4) for the willingness-to-pay quantity-response question revealed that most of the responses were zero or 100% of the current allotment. The percent of those answer-ing "none" rose steadily as the lease rate was raised. The logistic functional form provides a good fit and has many desirable properties for this type of binary response data. For this reason, a logit prediction model was estimated.[4] For this estimation, all-zero responses, upward-sloping responses, and responses that answered only a few questions were omitted, leaving 109 usable observations.

The specific computational program used was the BMDP Logistic Regression. Only variables with probability levels superior to 0.15 (based on the maximum likelihood ratio) were included. With these levels of tolerance, three variables were included in the logistic equation: price of federal grazing (PRICE), the percentage dependence on federal grazing (FED), and an interaction between PRICE and FED (table 2). It should be noted that the standard error for the PRICE coefficient is small relative to that coefficient. Because each of the estimated parameters has a normal asymptotic distribution (Manski and McFadden 1981), asymptotic confidence intervals around the estimated parameters can be calculated by adding and subtracting the appropriate t value (1.96 for 95% confidence) times the standard errors.

The equation predicting the probability of leasing is:

$$pr = \frac{1}{1 + e^{-4.40 + 0.877 \, PRICE + 1.49\% \, FED - 0.250\% \, FED*PRICE}}$$

By substituting the average dependency on summer federal grazing (49%), the logit equation can be expressed with price being the only independent variable:

[3]The variables were first standardized by dividing them by their standard deviation. This was done because one variable was measured on a 0 to 1 scale, and the others on a 1 to 4 scale. By measuring all variables in terms of standard deviations, variables with low standard deviations also tended to be weighted more heavily in the cluster analysis. Thus, atypical responses to variables with low standard deviations were given heavier weight in clustering the ranchers into groups.

[4]Using the 5% alpha error as a criterion for determining the number of independent variables, the following Ordinary Least Squares demand function was also arrived at (t-statistics are given in parentheses):

%QUANTITY = 1.04 - 0.106PRICE - 0.06FED + 0.00006SIZE
                    (-30.15)   (-2.00)   (1.94)

R^2 = .5963

With FED and SIZE set at their means (.49 and 330, respectively), the implied price-quantity relationship is PRICE = 9.72 - 9.43% QUANTITY. Because of the discrete nature of the responses, however, the logit model was considered more appropriate.

$$pr = \frac{1}{1 + e^{-3.67 + 0.7545 \text{ PRICE}}}$$

This equation is plotted as the logit form of a federal grazing demand curve in figure 5.

Comparisons of Demand Analysis with Other Valuations

Values from the demand curve in figure 5 can be compared with values derived from other techniques, with the caveat that response bias in the survey cannot be ruled out. Gee[5] estimated the value-marginal-product for federal grazing to be approximately $7.90 per AUM (after our adjustment from cow-calf pair units to AUM's). Similarly, Bartlett et al. (1981) found the value-marginal-product in Colorado to be $7.14 per AUM assuming a variable herd size and $8.21 per AUM assuming a fixed herd size. Both studies assumed "average" livestock prices for their time period. These values reflect an adjustment to 1983 values using the USDA price index for forage. It should be noted that both prices and price expectations for the future have diminished since 1980. More recent appraisals (USDA Forest Service and USDI Bureau of Land Management 1985) indicate a price of $5.31/head/month in northwest Colorado and $6.84/head/month in southwest and central Colorado. By comparison, the unpublished USDA "June Enumerative Survey" indicates a private forage price in Colorado of $8.70 per AUM. As noted earlier, our Colorado sample of ranchers indicated private forage lease rates of only $6.70 which is just three-quarters of the USDA estimate for the state. If the 1985 USDA-BLM estimates for federal forage were reduced accordingly to match our sample parameters, then a price of $4.08/head/month in northwest Colorado and of $5.25/head/month in southwest and central Colorado results.

The demand curve in figure 5 appears to be conservative, relative to these previous findings. However, as stated in USDA Forest Service and USDI Bureau of Land Management (1985) report, "...the public rangeland allotments within each of the pricing areas exhibit broad ranges in physical characteristics and the private leased lands exhibit the same general, broad ranges in these

[5]Gee, Kerry. 1982. *Values for Forest Service grazing for the Resource Planning Act. Unpublished report.*
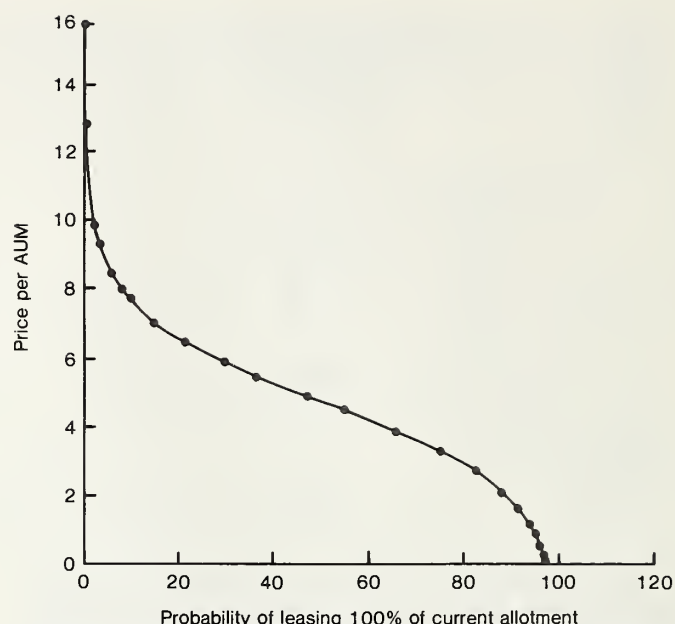

Figure 5.—The logit regression estimates of the willingness-to-pay quantity-response format demand curve plotted in price-quantity space. Shift parameters for the functions were set to the 1983 average survey values.

characteristics or factors." Thus, the previous findings generally reflect average marginal productivity.

Assuming that ranchers' responses in the survey are consistent with economic theory, the forage factor price associated with any given quantity should be the value-marginal-product of forage—the price of red meat times the marginal product of the forage in producing red meat. Because the price of red meat is effectively constant, the slope in the demand curve in figure 5 should be solely the result of diminishing marginal product. Thus, in order to compare figure 5 with the previous findings based on average marginal product, it may be necessary to take the weighted average demand price from figure 5 (about $5). This would still indicate that the CVM results are conservative, but only slightly so.

Conclusion

The results of this preliminary study suggest several indications regarding the CVM approach to valuation. Price-response CVM questions apparently tended to ex-

Table 2.—The maximum likelihood ratio logistic regression to estimate the probability of leasing a federal grazing allotment for the sample of ranchers responding to the willingness-to-pay quantity CVM format.

Variable	Coefficient	Standard error	Log likelihood	Goodness of fit	
				Chi-sq	P-value
Constant	−4.400	0.570	−322.8	645.59	0.000
%FEDERAL GRAZING xPRICE (INTERACTION)	−0.250	0.145	−275.0	549.98	0.004
%FEDERAL GRAZING	1.490	0.759	−228.6	457.16	0.568
PRICE	0.877	0.108	−169.2	338.34	1.000

hibit a haggler's effect that caused willingness-to-pay responses to differ substantially from willingness-to-sell responses. Ranchers tended to respond with the current federal fee when asked for willingness to pay and with the current private forage price when asked for willingness to sell. The degree to which this is a common phenomenon is impossible to determine from this study. It does seem reasonable to suggest, however, that CVM studies of, say, recreation areas might be affected by the current fee structure and institutions allocating use. Willingness-to-pay responses may reflect the current recreation use fee, while willingness-to-sell responses may reflect some private use fee or some perception of what other people would actually be willing to pay.

The results of the quantity-response willingness-to-pay CVM tended to be conservative. This is consistent with the findings reported by Bishop and Heberlein (1979) for goose hunting permits. The quantity-response type of CVM has not received a great deal of attention in the literature, but the results of this study suggest that it would be useful in situations where quasi-markets influence price responses.

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The Contingent Valuation Method (CVM) is applied in four different
formats to value federal range forage. Price-response formats tend to
elicit bids reflecting either the current federal lease rate (willingness
to pay) or the current private selling price (willingness to sell). This
type of influence from real world prices may explain some of the large
difference often observed between willingness-to-pay and willingness-
to-sell contingent valuations. Quantity-response formats tend to elicit
all or nothing bids. Logit demand functions are estimated for a
quantity-response willingness-to-pay format, and the results are com-
pared with other market-based valuations of federal range forage in
Colorado.

Rocky Mountains

Southwest

Great Plains

U.S. Department of Agriculture
Forest Service

Rocky Mountain Forest and Range Experiment Station

The Rocky Mountain Station is one of eight regional experiment stations, plus the Forest Products Laboratory and the Washington Office Staff, that make up the Forest Service research organization.

RESEARCH FOCUS

Research programs at the Rocky Mountain Station are coordinated with area universities and with other institutions. Many studies are conducted on a cooperative basis to accelerate solutions to problems involving range, water, wildlife and fish habitat, human and community development, timber, recreation, protection, and multiresource evaluation.

RESEARCH LOCATIONS

Research Work Units of the Rocky Mountain Station are operated in cooperation with universities in the following cities:

Albuquerque, New Mexico
Flagstaff, Arizona
Fort Collins, Colorado*
Laramie, Wyoming
Lincoln, Nebraska
Rapid City, South Dakota
Tempe, Arizona

*Station Headquarters: 240 W. Prospect St., Fort Collins, CO 80526